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Science and strategic communication: how can universities attract high school students?

Abstract
As the use of new media and the new uses of traditional media evolve in the contemporary This is a study on the use of science communication as a component of the promotional mix prepared by universities to attract high school students to their graduate and postgraduate programmes. It proposes the concept of strategic science communication, to name strategic communication practices that use science popularization to reach successful organizational performance. And this proposal was tested through a survey applied to high school students, within the area of influence of the University of Minho, in Portugal. The survey was designed according to a model of analysis developed to study the ability of strategic science communication to act on awareness (familiarity), enjoyment (appreciation), interest (voluntary involvement), opinion (way of thinking), understanding (comprehension), interaction (contact activities) and action (attitude); by extending Burns et al. (2003, p.191) vowel analogy. In the end, results point out: (1st) to the relevance of strategic communication activities in the process of promoting information and interaction with science; (2nd) to the positive effect of science communication activities in the desire to apply for a higher education institution; and (3rd) to the pertinence of the strategic science communication concept in universities' communication mix.

Keywords: Science communication; strategic science communication; strategic communication; public relations; communication in universities

Introduction

Portuguese universities have an increasing interest in Science Communication activities to non-specialized publics. This trend has been growing since the 1990s, as these institutions entered the market context, which forced them to compete for students and funding. As a consequence,

Science Communication frequently assumed marketing purposes, seeking to attract young people to graduate and postgraduate programmes. In fact, communication campaigns began inviting high school students to visit university campuses with the pretext of engaging them in the work of science - through conferences, lab experiences or personal contacts -, although the real purpose was (very often) to share information on its programmes and future careers, through communication activities designed to reach young people's emotional perceptions. The expectation was: 'the more you know, the more you love it' (Bodmer, 2010).

Following this phenomenon, we have gathered a research team with teaching careers on Basic and Social Sciences (Communication Sciences), along with a wide experience in Science Communication activities over the years, to study the use of *Strategic Science Communication* (that is, science communication activities with marketing purposes) to enhance the *awareness/understanding* of science as a mechanism to attract Portuguese high school students to universities. The study was conducted within the area of influence of the University of Minho (north of Portugal) and this work presents the results of the research.

Literature Review

Science Communication

Science communication is an established area of research within Communication Sciences. It studies the efforts developed by science agents not only to share their research work within the scientific community, but also the programs that aim to inform citizens about the scientific advances and to engage them with the work of science and the life of scientists.

As is well known, science has a strong influence on all aspects of our daily life and it is crucial to the technological, social, cultural and economic growth. This is why it is essential that the whole universe of science is not confined to the space in which it is produced. In order to reach that purpose, communication is the key. Communication is the link between the production of scientific knowledge and the general public.

Traditionally, Science Communication was developed through the publication of research results in specialized journals, in thesis formats or through oral presentations in academic seminars, as expressions of a *closed by nature* community (Kuhn, 1998). However, throughout the last century, the interest in the public communication of science grew, that is,

the dissemination of science to non-specialized publics increased. And this is a key element to the democratic exercise (Bauer, 2009), as it can enhance the quality of information in the public space, improve the transparency on the application of public funding, and contribute to a more informed citizenship. This understanding was moreover advocate by the Royal Society of London on the famous report *Public Understanding of Science* (PUS), in 1985, whose main thrust was "directed at the need for scientists to learn how to communicate with the general public in all its guises, and to consider it a duty to do so" (Bodmer, 2010, p. 1). The report represents an important moment in Science Communication history, because for the first time this renowned association for the advancement of science adopted a more open attitude, towards the enhancement of the understanding and appreciation of the scientific work by the general public.

Science is that wide and complex universe of knowledge development. As Morin (1994, p. 17) states, "the question 'what is science?' is the one that still has no scientific answer". Well-known scientists have proposed some very interesting definitions, as Einstein, (2005) who suggested that science is the *refinement of the common thought* or Feynman, (1998) who sees it as *an understanding of Nature*. The concept embodies experimental perspectives (Oppenheimer, 1954), social visions (Morin, 1994), methodological paradigms (Burns et al., 2003) and freethinking trends. But in its very essence, science is "the systematic enterprise of gathering knowledge about the world and organizing and condensing that knowledge into testable laws and theories" (American Association for the Advancement of Science, 1989).

However, its methods, rules, rituals and languages are hard to understand by the average citizen. In order to break this isolation, States, transnational organizations and opinion leaders advocate the development of a "scientific citizenship" (Carvalho & Cabecinhas, 2004), a concept that incorporates the value of participation in the scientific field. In addition to the benefits of science education to democracy and development, the interest of States to increase political regulation and public scrutiny on scientific research is also evident, as they face globalization phenomena, reduction on public funding capacity, and an increase in economic and political competition.

The Portuguese scenario is rather similar (Bettencourt-Dias et al., 2004). Science has broken its isolation and has sought to become more international, through the work of a scientific community that has been alerted to the importance of creating publics for science, building applied knowledge, and contributing to the nation's growth. While fighting for national and international funding to survive, Portuguese scientists

– mostly working in our public universities – have realized that a continuous interaction with society is needed in order to get public, political and social support (Gago, 1991; Magalhães, 2014).

Although the tradition of Science Communication research is to consider only "pure science" (as Mathematics, Statistics, Engineering, Technology, Medicine, and related fields; Burns et al., 2003), we have decided to take the concept on a much boarder contemporary meaning in order to include humanities and social sciences (following Fenton et al., 1998). We find no reason to exclude these disciplines from the definition, as they are also involved in science communication activities, as our study will demonstrate. And this is the vision we took when looking at universities as science producers and science communication actors.

Communicative Universities

For centuries, academic institutions – namely public universities – were seen as sacralised 'fountains of knowledge', above common interests and ordinary access. Young men and women had to struggle to be admitted into such prestigious institutions. But the changing status of the university sector worldwide began in the early 1970s and it was due to the growth of *knowledge society* (Jarvis, 2001). These institutions have gone from training a selected elite, to become mass educators. Their governance models changed from "administrative universities" to "strategic management universities" (Clark, 1998). Their objectives have also been altered significantly, and they currently include solving society's economic and social problems through the providence of lifelong education to the population. And its classical principles have been questioned, such as autonomy, collegial democracy or freethinking. Universities have become a certain kind of 'service providers', supplying training and technological development to communities.

Some structural changes, happening in the last century, may explain this turnover: the globalization phenomenon has brought competitiveness to the higher education sector; governments began demanding more expertise from these institutions while reducing their financial support; demographic changes led to a decline on the number of students running for higher education; and the communities have been requesting a stronger sense of accountability to these institutions. As a result, during the 1980s and 1990s, established institutions on higher education began responding to these threats by adopting an *entrepreneurial spirit* (Clark, 1998), that is, by expanding enrolments, increasing the variety of programmes and courses, cutting costs, acting competitively, and entering the advertising arena.

Since then, these organizations have been acquiring a promotional attitude that implies spending more and more time marketing themselves through 'product/service' development, advertising or branding activities. 'Marketization' in education refers precisely to the adoption of free market practices in running schools, including some business trends such as cutting 'production costs', abandoning goods no longer in demand or producing only popular products (Askehave, 2007), but also leveraging brand reputation through communication strategies (Chapleo, 2005).

Traditionally, public universities focused on their social 'prestige', which was built on the quality of their educational services and measured through the results of their graduates. More recently, however, 'image' and 'reputation' became new values for universities, or assets expected to be managed through communication programmes. Universities worldwide, then, began looking for a strategy to promote their names, logos, 'perceived quality', as a way to create 'a distinct brand personality'.

In short, towards the end of the 20th century, public universities (somewhat all over the world) assumed corporate shapes and marketing communication orientations, which became routine procedures all over our century. These trends were also felt in Portugal, as we will explain in the next section.

The Portuguese case

The higher education sector in Portugal has been facing a major change throughout the two last decades, and its communication became increasingly commercial.

Portugal had an elite higher education system until the 1970s, with 100.000 students in 1975/76. Since then, the number of public and private higher education institutions has increased enormously and the number of students in the system has tripled. However, regulating and financing this massive increase turned out to be a difficult task for Portuguese governments that began inducing quality regulation and economic self-sustainability during the 80s and 90s. The State believed that the best regulation model was the 'market paradigm', following international trends. Still, the Portuguese State kept an important role on the process, evaluating universities' performances and controlling information given to the market[1] (Ruão, 2008).

To market environment, economic constrains and pressures to strategic governance, Portuguese public universities responded with the

[1] Through CNAVES (the National Council of Higher Education Evaluation), 1998-2006; and A3ES (the Agency for Assessment and Accreditation of Higher Education), since 2007.

cautious development of mass communication and marketing activities, beginning in the middle nineties. Communication purposes were redefined: attracting students and funds was identified as the most important objective. The *intangible* factors became crucial to distinguish services and increase attractiveness. The classic public relations departments (with protocol and administrative communication functions) were replaced by strategic communication and marketing functions. This change on structures and communication perspectives led to some radical transformations on their traditional models. Communication became a new strategic tool to leverage cultural transformation, to enhance image, to attract students and funds, in short to react to changing pressures. Within the communication mix, Portuguese universities selected advertising, exhibitions, promotional brochures, science events, online channels, brand names and logos as their main instruments to fight for identity awareness and trust status (Ruão, 2008).

University publics were now perceived as 'stakeholders' and ranked differently. *Prospective students* became their most important external public, whereas in the past they were ranked on a minor position (after *state lobbying* or *peer relations)*. *Evaluation agencies* and *companies* were converted into strategic publics, as fund providers. Their *students, media* and *opinion leaders* were assumed as relevant vehicles of information and involvement, generating *worth of mouth* effects (which is the strongest mechanisms to image development on higher education; Ivy, 2001; Kazoleas et al., 2001). *Local communities, authorities, state rulers, competitors* and *staff members* continued to be considered as relevant targets, but the pressure for immediate success changed the communication axis to publics understood as clients/consumers and fund providers.

Strategic Science Communication

As described above, strategic communication management – that is, the orchestrated use of messages and channels to maximize communication impact, to influence publics and to move towards well-considered organizational goals (Hallahan et al., 2007; Argenti et al., 2005) – is now common in Portuguese universities and in the international academic context. Amongst the different forms of strategic communication they use, we emphasize *strategic science communication* or the promotional process of enhancing the understanding of science as a mechanism to attract high school students to universities.

Burns and his colleagues (2003, p. 191) define Science Communication as "the use of appropriate skills, media, activities, and dialogue to produce

one or more of the following personal responses to science (the vowel analogy): ***A**wareness*, including familiarity with new aspects of science; ***E**njoyment* or other affective responses, e.g. appreciating science as entertainment or art; ***I**nterest,* as evidenced by voluntary involvement with science or its communication; ***O**pinions*, the forming, reforming or confirming of science-related attitudes; (and) ***U**nderstanding* of science, its content, processes, and social factors". Science communication to be effective implies, therefore, a strategic process that enables a set of sequential mental responses to the messages send through the most suitable channels. So, Science Communication can be strategic in process, although it was designed to promote science dissemination and education, with no marketing or commercial purposes.

What we propose to do in this paper is, then, to enlarge the conceptualization of Science Communication, in order to integrate strategic communication practices that use science popularization as a way to attract new students to the educational services managed by universities. The communication of science activities is seen, within this context, as a component of the promotional mix - along with branding, media relations, crisis communication or reputation management -, run or driven by the communication departments. And this proposal comes from our observation (Ruão, 2008) and involvement in science communication activities along the years, by which we perceived the strategic use of science education as a path to reach successful organizational performance regarding prospective students. And this is a phenomenon found in the performance of both "pure science" programs, as humanities and social science ones.

Our study

In order to test our proposal, we conducted a study on the use of *strategic science communication* to attract high school students to universities. This work follows a research we have developed in 2010 (Ruão et al., 2012), on the image of science held by Portuguese high school students, as an instrument to collect useful data for communicating and attracting them to higher education. The survey suggested that science and scientists have a very positive image amongst high school students, but it also indicated that we should rethink a boarder study. Students within our sample considered science an interesting and valuable activity, and they believed scientists were helpful and creative individuals. Their *awareness* level (familiarity) was, therefore, high and this is an important piece of

information for communicators, because it can support their work and suggest new directions for strategic communication programmes. But if awareness is high, communication should seek other more evolving effects such as *understanding*, *enjoyment* or *interest* (as suggested by Burns et al., 2003) in order to bring the public to the next level: action, by entering graduate or postgraduate programmes.

Following all these guidelines, we appointed a research question that summarizes our main concern: *how can strategic science communication attract high school students to universities*? To assess the validity of our proposal - that science communication has a strategic dimension that can produce marketing results regarding applications to universities -, a pilot study was conducted within the area of influence of the University of Minho (UMinho). The study involved 338 students, aged between 14 to 19 years, and attending the last years of high school (10th, 11th and 12th grades) in the city of Braga. We have used a survey instrument, applied to a non probabilistic sample. The survey was conducted in October 2014. The sample included male (173) and female (165) students attending different areas of study: arts, humanities, economics, sciences and technologies. The questionnaire was applied in class by the teachers selected based on their willingness to help.

The survey was designed according to a model of analysis (table 1) developed to study strategic science communication ability to act on *awareness* (familiarity), *enjoyment* (appreciation), *interest* (voluntary involvement), *opinion* (way of thinking) and *understanding* (comprehension), following Burns' vowel analogy; which was complemented with two other effects: *interaction* (contact activities) and *action* (attitude –behaviour intention). Furthermore, we assumed that this was a sequential process, as stated by the brand management literature (Aaker, 1991, or Keller, 1993). The model was designed based on the identification of the problem dimensions (strategic science communication functioning), and on the isolation of the communication phenomena involved (the extended vowel analogy). With that information, we developed a questionnaire that is presented below.

Problem Dimensions	Question	Communication Phenomena
1. Familiarity with Science	*Do you think science is important for society?*	Awareness of Science Opinion
2. Comprehension of Science	*What is the work of science?*	Understanding of Science
3. Contacts with Science	*In which circumstances do you contact with science?*	Interaction
4. Involvement with Science	*Which science activities do you like best?*	Enjoyment
5. Attraction for Science	*Could science be your future profession?*	Interest/Action
6. Attraction for HE	*Do you have plans to take a university degree?*	Interest/Action
7. Contacts with UMinho	*How did you come in touch with the UMinho teaching projects?*	Interaction
8. Attraction for UMinho	*Do you have plans to apply for the UMinho?*	Interest/Action

Table 1: Strategic Science Communication Model of Analysis

Studies on the perceptions of science and scientists held by young people have been conducted in different countries for a long time (MacCorquodale, 1984; Lee, 1998; Jones et al., 2000; Sjoberg, 2000; and others). However, looking for a different approach to science communication activities but inspired by these recognized studies, we prepared a short questionnaire, assessing 8 matters. In question 1 (on awareness), students were asked to rank the importance of science in a scale: from totally agree, to totally disagree. Questions 2 (understanding), 3 (interaction), 4 (enjoyment), and 7 (interaction) included prepared statements, and students were asked to mark the sentences that best expressed their views on science and on contacts with the University of Minho. On questions 5, 6 and 8 (on interest and/or action), students should reveal their intentional involvement through a yes or no answer. The results are presented and discussed in the next section.

Results and Discussion

Students' gender, age and school grade were not significant to the results. There is a balance in the sample between male and female students, and their age is consistent with the school grade they are attending.

Following the 2010 results, we can confirm a high *public awareness of science* (chart 1), as the students have answered very positively to the question on the importance of science.

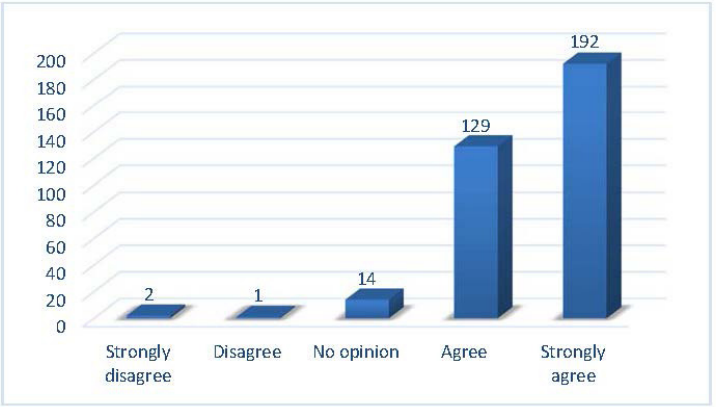

Chart 1: Public Awareness of Science
Do you think science is important for society?

Also following previous results, students presented a reductionist *public understanding of science* (table 2): mainly oriented to pure science, not considering humanities and social sciences, and not regarding science as entertainment or art.

Answer option	Frequency
Science studies mathematics and statistics	248
Science studies society	169
Science studies engineering and technology	266
Science studies arts	63
Science studies animals and plants	306
Science studies literature	50
Science studies the human being	316

Table 2: Public Understanding of Science
What is the work of science?

Students seem to make contact with science (table 3) mainly through school activities, internet, museums/exhibitions, school visits/summer camps, seminars and mass media. And they seem to have lower contacts with scientific activities through cinema, literature, arts (confirming previous analysis on the reductionist view of science), and visits to higher education institutions. Science communication is, then, associated with interaction spaces.

Answer options	Frequency
At school	282
In lectures, workshops, seminars, conferences or exhibitions	99
In guided tours, scientific holiday camps or laboratory experiments	156
In visits to universities	9
In science museums or live science centers	205
In cinema, literature or arts	96
In newspapers, television or radio	203
In internet and social networks	215
In family contexts	88
Other. Which?	9

Table 3: Interaction with Science
In which circumstances do you contact with Science?

On the enjoyment issue (table 4), students state they prefer to come in touch with science through *hands on* approaches, as laboratory experiments, school visits, summer holiday camps, museums, science centres, classroom activities, mass media and visits to higher education institutions. But they do not perceive seminars, websites or arts as interesting ways of interacting with scientific activities.

Answer option	Frequency
Classes	95
Laboratory experiments, guided tours or scientific camps	226
Lectures, workshops, seminars, conferences or exhibitions	31
Visits to Universities	83
Visits to science museums or live science centers	161
Programs about science (radio, television, newspapers)	88
Arts, music, cinema or literature	42
Online activities	26
Other. Which?	7

Table 4: Enjoyment with Science
Which science activities do you like best?

On question 5, about taking science as a career in the future, students had dichotomous opinions: 51% said *yes* and 47% said *no* (chart 2). In other words, they present moderate intentions for voluntary involvement.

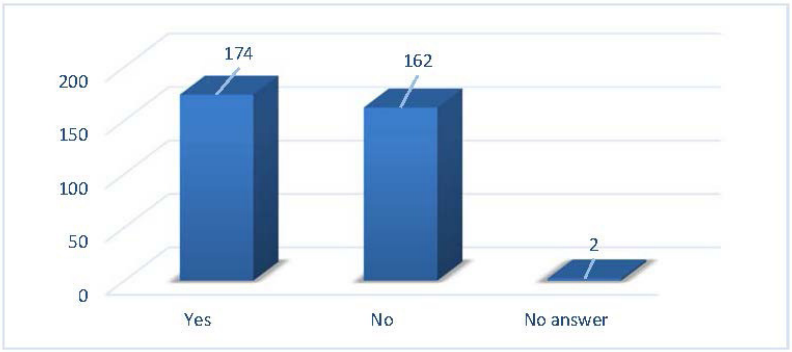

Chart 2: Interest/Action on Science
Could science be your profession in the future?

In spite of this ambivalent positioning on science involvement, most students said they would run for a higher education degree (chart 3). Regarding university access, *interest* and *action intentions* are high.

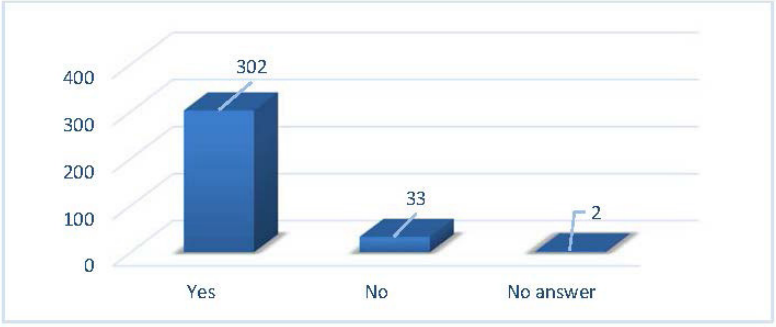

Chart 3: Interest/Action on Higher Education
Do you have plans to take a university degree?

Concerning the University of Minho (table 5), students said they came in touch with the institution mostly through family and friends, school, mass media, websites and facebook, visits to the campus, and higher education exhibitions. Fewer contacts happened by participating in the UM summer camp or the best student' program. Hence, within the quoted forms of *interaction*, we can identify strategic communication practices and science communication activities.

Answer option	Frequency
Through family and friends	302
Through news on television, newspapers or radio	148
Through the UMinho's website or facebook	114
In lectures, seminars and exhibitions held at UMinho	56
In tour guides and laboratory experiments at UMinho	69
At school (through teachers, psychologists or exhibitions)	173
In higher education fairs	67
By participating in the UMinho summer camp ("Verão no Campus")	28
By participating in the Best Students Program ("Os melhores alunos na UMinho")	12
Other. Which?	10

Table 5: Interaction with UMinho
How did you come in touch with the UMinho teaching projects?

Finally, on their *intention* to run for the University of Minho (chart 4), 69% said they will apply to the institution, but 30% believe they will look for other higher education institutions or professional solutions. Given that our sample is composed of residents in the city of Braga (or surroundings), it is significant that 30% of the students are not compelled to apply for the institution. We would expect that the city of Braga - housing the University – could be successfully convinced to apply for the UMinho. These results, however, show that there is still much work to do regarding strategic communication, to inform and engage those publics in action.

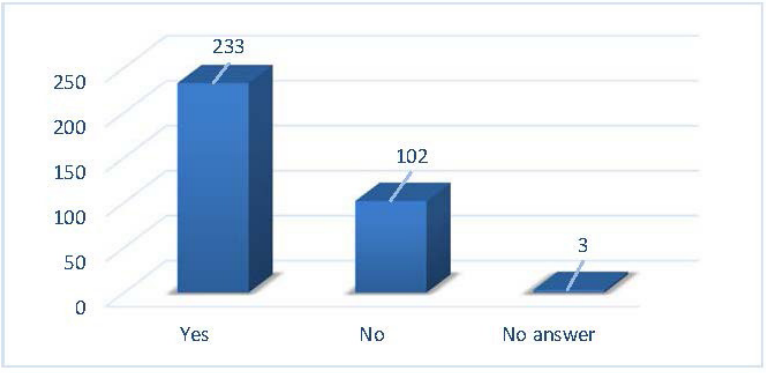

Chart 4: Interest/Action in UMinho
Do you have plans to apply to the UM?

Conclusions

The pilot survey described above was designed to analyse *how strategic science communication can attract high school students to universities*. The results can be summarized in the following ideas: (1) students within our sample have a high and positive awareness of science, but they present a reductionist understanding of the field; (2) they develop a high interaction with science through classical channels (such as school or museums) and new ones (such as internet); (3) hands on (or experimental practices) are the most enjoyed activities; (4) there is a moderate level of interest/action in Science; and (5) family and friends are the most effective informational/involvement channels. This scenario – of high awareness, incomplete understanding, some enjoyment and moderate interest in science/UM - induced a certain course of action: 69% of students think they will apply to UMinho.

Following these conclusions, we developed a set of recommendations to enhance communication efficacy (that is, to act on the increase of applications), exposed in *the Strategic Science Communication Model* (summarized in table 6). The 'marketization' of Science Communication demands for the establishment of goal-oriented *communication politics,* based on: a two-way communication design (Grunig, 2001), long-term communication planning practices, intentional messaging architecture to reach the targets, and regular assessment procedures.

As *strategic guidelines,* we advocate: the promotion of *hands on* activities and personal contacts; the stimulation of the word of mouth and repeated experiences with the brand; the promotion of a *cool* (young and pragmatic) image of science; and the development of the *scientists' understanding of the public* (Burke, 2015). These guidelines should be applied to a coherent *communication mix*, based in the following techniques: branding, public relations/media relations, events, online promotion, and communication training.

We highlight this final idea that a two-way communication model demands also for the *scientists' understanding of the public*, deconstructing their misperceptions about the audiences that help intensify miscommunication. Citizens need more information, but also need *better* communication. As stated by Burke (2015), language, length, presentation, framing, venue, medium, and sources are very important. And scientific training includes a specific language and communication devices designed to enable researchers to communicate with colleagues clearly. But this

common dialect used among scientists does not necessarily communicate ideas effectively outside their universe. Scientists speaking to the public do not spend enough time studying the lexicon and concerns of their audience to meet them where they are. And scientists are not always seen as warm, although they are generally seen as competent (Burke, 2015). However, *strategic science communication* requires scientists to get closer to their publics, in spite their reticence to public exposure.

Communication Politics	
Two-way communication model	
Long-term planning	
Messaging architecture	
Evaluation system	
Strategic Guidelines	**Communication Mix**
Hands on and personal contacts	Events management
Word-of-mouth	Media relations programs Events management
Repeated experiences	Public Relations Brand management
Cool image of science	Online Communication Events management
Scientists' understanding of the public (SUP)	Communication Training Media Training

Table 6: The Strategic Science Communication Model

The *Strategic Science Communication Model* is, therefore, our proposal to answer the research question. We believe that the study demonstrates: (1st) the relevance of strategic communication activities in the process of promoting information and interaction with science; (2nd) the positive effect of science communication activities in the desire to apply for a higher education institution; and (3rd) the pertinence of the strategic science communication concept in universities' communication mix. Thus, *strategic science communication can attract high school students to universities* by leveraging the value of scientific knowledge, which enhances brand awareness and strengthens organizational reputation.

To finish, we should point out the limits of the questionnaire in order to put the results in perspective and to prepare a broader study.

The scientific areas attended by the students in high school (humanities, sciences, technologies, economics and arts) should have been considered, as different interests can produced diverse responses (but that could not be assessed in the study). Furthermore, the reasons why thirty per cent of the students do not want to apply to the UMinho should have been identified (with a minimal inquiry: *why?*).

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